

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Currently Amended) Biometric, acoustic writing system ~~(1)~~ having:

(a) a pen housing ~~(3)~~ for making hand-guided movements on a substrate ~~(4)~~;

(b) at least one microphone ~~(5)~~, which is integrated in the pen housing ~~(3)~~, for acoustic recording of sound signals which are caused by the hand-guided movements;

characterized by

(c) ~~and having~~ a data processing unit ~~(11)~~ for calculation of biometric data as a function of ~~the recorded sound signals that are recorded.~~

Claim 2 (Currently Amended) Biometric, acoustic writing system according to Claim 1, characterized in that

the data processing unit ~~(11)~~ is provided for obtaining biometric features and for reconstruction of handwritten characters and texts from the recorded sound signals.

Claims 3 and 4 (Canceled)

Claim 5 (Currently Amended) Biometric, acoustic writing system according to ~~one of Claims Claim 1 to 4~~, characterized in that

a pen is provided in the pen housing,

the substrate is a fixed writing substrate which has a specific pronounced surface roughness and hardness,

the hand-guided movement is a writing movement, and

the friction of the pen (2), when placed on the substrate (4), is capable of creating friction on the substrate during the hand-guided writing movement, produces thereby producing an acoustic writing noise, which is capable of being transmitted to the microphone, as a structure-borne sound signal via

the pen (2) and as an airborne sound signal via the surrounding air to the microphone (5).

Claim 6 (Currently Amended) Biometric acoustic writing system according to Claim 5, characterized in that
the microphone (5) is mechanically coupled to the pen in order to transmit the structure-borne sound signal.

Claim 7 (Currently Amended) Biometric, acoustic writing system according to Claim 5, characterized in that
the microphone (5) is mechanically coupled to a sound body (6), which is connected to the pen (2), in order to transmit the structure-borne sound signal.

Claim 8 (Currently Amended) Biometric, acoustic writing system according to Claim 7, characterized in that
the sound body (6) is in the form of a resonator for specific natural frequencies.

Claim 9 (Canceled)

Claim 10 (Currently Amended) Biometric, acoustic writing system according to Claim 9 1, characterized in that
the microphone is arranged in an air bearing sound chamber, which is provided in the pen housing with the air-borne air bearing sound chamber (7) is being in the a form of a resonator for specific natural frequencies.

Claim 11 (Currently Amended) Biometric, acoustic writing system according to Claim 10, characterized in that
an interchangeable pen refill with an ink filling is provided as a pen in the pen housing, and
the microphone (5) and the resonator are surrounded by sound insulation (8), which is intended to attenuate environmental noise and passes sound signals only via the writing refill.

Claim 12 and 13 (Canceled)

Claim 14 (Currently Amended) Biometric, acoustic writing system according to Claim ~~12~~ 5, characterized

in that,

when the housing opening is open, the microphone ~~(5)~~ acoustically records the internal and external writing noise which is caused by the hand-guided writing movement as a structure-borne and airborne sound signal ~~and/or~~ or acoustically records a speech signal which originates from a person or both.

Claim 15 – 18 (Canceled)

Claim 19 (Currently Amended) Biometric, acoustic writing system according to Claim 1, characterized

in that

the writing substrate ~~(4)~~ is composed of any desired paper.

Claim 20 – 22 (Canceled)

Claim 23 (Currently Amended) Biometric, acoustic writing system according to Claim 1, characterized in that

a pen is provided in the pen housing, and

a pressure sensor device is additionally provided, which records ~~the~~ a static writing pressure and a dynamic writing pressure in at least one spatial direction of the ~~hand-guided pen which has been~~ when the pen is placed on the substrate and hand-guided.

Claims 24 – 44 (Canceled)

Claim 45 (Currently Amended) Biometric writing system according to Claim 23, characterized in that the pressure sensor device ~~(34) has electromechanical pressure sensors, which comprise~~ comprises piezoelectric sensors, piezoresistive sensors, force-sensitive resistances, ~~and~~ magnetic sensors, or a combination thereof.

Claims 46 – 48 (Canceled)

Claim 49 (Currently Amended) Biometric writing system according to Claim 1, characterized in that the data processing unit ~~(11)~~ is integrated in a the pen housing ~~(3)~~ or in an external receiving unit.

Claims 50 and 51 (Canceled)

Claim 52 (Currently Amended) Biometric writing system according to ~~one of the preceding claims~~ Claim 1, characterized in that
a scrambling unit (17) is provided in the pen housing (3) in order to scramble reference data ~~for the sensor signal data~~.

Claim 53 (Canceled)

Claim 54 (Currently Amended) Biometric writing system according to ~~one of the preceding claims~~ Claim 1, characterized in that
a data memory is provided for storage of biometric reference data, ~~position and of data for the writing movement~~ handwritten characters, texts and spoken information speech.

Claim 55 (Currently Amended) Biometric writing system according to ~~one of the preceding claims~~ Claim 54, characterized in that
the biometric reference data is calculated by the data processing unit (~~11~~) from the sound signal data which is recorded while writing and speaking at least one word, from optical movement data, from mechanical oscillation and pressure data, and from inclination data, and is stored in a reference data memory.

Claims 56 - 64 (Canceled)

Claim 65 (Currently Amended) Biometric writing system according to ~~one of the preceding claims~~ Claim 55, characterized in that the data processing unit is integrated with a local computer having a computer data processing unit, and the data processing unit (~~11, 19~~) and the computer data processing unit ~~compares~~ compare the calculated current biometric data with the stored biometric reference data in order to verify and identify it.

Claim 66 (Currently Amended) Biometric writing system according to Claim 65, characterized in that
the data processing unit (~~11, 19~~) and the computer data processing unit ~~produces~~ produce an identification indication signal, and/or a verification indication signal, or a combination thereof when the current biometric data largely matches the stored reference data.

Claim 67 (Currently Amended) Biometric writing system according to Claim 66, characterized in that

the data processing unit ~~(11, 19)~~ and the computer data processing unit identifies identify the current biometric data as a stolen copy of the stored reference data, and ~~produces produce~~ a warning signal, if the current biometric data completely matches the stored biometric reference data.

Claims 68 and 69 (Canceled)

Claim 70 (Currently Amended) Biometric writing system according to ~~one of the preceding claims~~ Claim 55, characterized in that

single characters which are currently being written are reconstructed by means of the stored biometric reference data for a person who has been identified or verified via the handwritten input.

Claim 71 (Currently Amended) Method for generation of personal-specific biometric reference data having the following steps:

- (a) acoustic recording of hand-guided writing movements which are carried out by a person using a pen ~~(2)~~ on a substrate ~~(4)~~ while writing a character, a word or a word sequence, and production of corresponding sound signal data;
- (b) storage of the sound signal data that is produced, as a digital sound time signal;
- (c) simultaneous recording of writing pressure signal data for the writing pressure, which data is transmitted from the pen to at least one pressure sensor;
- (d) storage of the writing pressure signal data that is produced, as digital time signals;
- (e) calculation of ~~associated~~ frequency spectra as a spectrogram from the stored time-segmented sound and pressure time signal data signals by means of a fast Fourier transformation;
- (~~d~~) (f) determination of amplitude time signals of selected frequencies in order to record the amplitude dynamics in the calculated spectrogram, of the sound and pressure time signals;
- (~~e~~) (g) calculation of an associated frequency spectrum from the selected amplitude time signals by means of fast Fourier transformation;
- (~~f~~) (h) determination of first biometric data by means of feature extraction from the sound and ~~oscillation~~ intensity of the digital time signals by means of feature extraction;
- (~~g~~) (i) determination of second biometric data by means of feature extraction from the ~~calculated spectrogram of the time-segmented sound and oscillation~~ pressure time signals by means of feature extraction;

- (h) (i) determination of third current biometric data by means of feature extraction from the calculated frequency ~~spectrum~~ spectra of the acoustic amplitude from the time signals;
- (i) (k) determination of fourth ~~current~~ biometric data by means of feature extraction from recorded the calculated frequency spectra for the amplitude time signals of the dynamic writing pressure, ~~oscillation and inclination~~ data.

Claims 72 - 79 (Canceled)

Claim 80 (Currently Amended) Method according to Claim 71, characterized in that biometric reference data is determined ~~from sensor signal data by feature extraction in the time domain, space domain and frequency domain, and is stored in a training phase and current biometric reference data memory as personal specific biometric reference~~ is determined in an operating phase, from the acoustic writing signal data and the writing pressure signal data for corresponding characters, sketches or words, and the biometric reference data and the current biometric data are stored.

Claims 81 - 86 (Canceled)

Claim 87 (Currently Amended) Method for verification and identification of a person, having the following steps:

- (a) ~~acoustic recording of hand guided writing movements which are carried out by a person using a pen (2) on a substrate (4) while writing a character, a word or a word sequence, and production of corresponding sound signal data;~~
- (b) ~~production of writing pressure signal data for the writing pressure and production of oscillation signal data for oscillations which are transmitted from the pen to at least one pressure and oscillation sensor;~~
- (c) ~~storage of the signal data that is produced at digital time signals;~~
- (d) ~~calculation of frequency spectra as a spectrogram from the stored time-segmented sound and oscillation time signals by means of fast Fourier transformation;~~
- (e) ~~determination of amplitude time signals of selected frequencies in order to record the amplitude dynamics in the spectrogram of the sound and oscillation time signals;~~
- (f) ~~calculation of an associated frequency spectrum from the selected amplitude time signals by means of a fast Fourier transformation;~~
- (g) ~~determination of first current biometric data from the sound and oscillation intensity of the~~

- ~~digital time signals by means of feature extraction;~~
- (h) ~~determination of second current biometric data from the oscillation time signals by means of feature extraction;~~
- (i) ~~determination of third current biometric data by means of feature extraction from frequency spectra of the amplitude time signals;~~
- (j) ~~determination of fourth current biometric data by means of feature extraction from the dynamic writing pressure data; and;~~
- (k) comparison of the current biometric data with stored biometric reference data for that person in order to verify whether the current biometric data largely matches the stored biometric reference data for that person;
- (+) (b) comparison of the current biometric data with stored biometric reference data for a large number of people in order to identify whether the current biometric data largely matches the stored biometric reference data for one of the stored people.

Claim 88 (Currently Amended) Method according to Claim 87 80, characterized in that a speech signal which originates from the person is additionally acoustically recorded, and corresponding sound signal data is produced.

Claim 89 (Currently Amended) Method according to Claim 87, characterized in that the biometric data from the speech signal data is ~~widened~~ evaluated in conjunction with the writing signal data, for verification and identification.

Claim 90 (Currently Amended) Method according to Claim 87 71, characterized in that ~~biometric data from a fingerprint which originates from the person sensor is additionally recorded via a tactile sensor which is integrated in a pen sleeve, and corresponding biometric fingerprint data is produced widened in conjunction with the writing and speech signal data, for verification and identification.~~

Claim 91 (Currently Amended) Method according to Claim 87 90, characterized in that biometric data from ~~an inclination data sensor is additionally widened in conjunction with~~ the writing signal data and speech signal data is evaluated in conjunction with the fingerprint data, for verification and identification.

Claims 92 - 96 (Canceled)

Claim 97 (Currently Amended) Method according to ~~one of the preceding Claims~~ Claim 87 to 96, characterized in that a speech signal which originates from the person is additionally acoustically recorded, and corresponding sound signal data is produced.

Claims 98 - 101 (Canceled)

Claim 102 (Currently Amended) Method according to ~~one of the preceding Claims 87 to 96~~ Claim 90, characterized in that ~~characters, image elements, sketches, word segments, or words which are obtained from the acoustic handwriting identification are evaluated using biometric data from the writing signals, speech signals or fingerprints for verification and identification, the identification being biometric pin identification or word sequences are determined in a corresponding manner from the correlated feature vectors of the recorded signal data by means of statistical, connectionistic and knowledge based methods.~~

Claim 103 (Currently Amended) Method ~~for handwriting identification and/or handwritten sketch identification according to Claim 87~~ Claim 88, characterized in that the acoustic handwriting and handwritten sketch identification is carried out from the acoustic and optical writing and speech signal data by means of software for the speech identification are integrated in one writing system, and methods for text image identification therefrom are combined with one another.

Claims 104 - 114 (Canceled)